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COMPARING THE MEAN PLATELET VOLUME IN DIABETIC AND NON-DIABETIC SUBJECTS

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ABSTRACT

Background: There have been reports of platelet changes in individuals with diabetes mellitus, and these changes have been connected to an increased risk of vascular problems.

Aim: The objective is to compare the mean platelet volume of individuals with and without diabetes in a medical facility in India.

Methods: 300 individuals with type 2 diabetes mellitus and 300 individuals without the disease were evaluated in this study. Every individual underwent a thorough examination after a thorough history was documented. A biochemistry analyzer and automated cell counter were used to calculate the HbA1c, MPV (mean platelet volume), PPBS (post-prandial blood sugar), FBS (fasting blood sugar), and platelet counts in each individual.

Results: The study's findings demonstrated that, with a p-value of less than 0.05, the mean platelet volume of diabetes participants was substantially larger than that of non-diabetic subjects.

Additionally, it was observed that the HbA1c levels of diabetic subjects were higher than 6.5%, while those of non-diabetic subjects were lower than 6.5%. In subjects with diabetes, platelet counts decreased. Additionally, there was a noteworthy correlation between MPV FBPS and PPBS. There is no discernible correlation between MPV and the duration of diabetes mellitus.

Conclusion: The study's findings indicate that mean platelet volume is substantially correlated with diabetes mellitus, especially in those with inadequate glycemic control and predictive biomarkers for vascular complications of the disease.

Keywords: diabetes mellitus, mean platelet volume, platelet counts, fasting blood sugar

INTRODUCTION

The complicated metabolic disease known as diabetes mellitus, which is typified by hypoglycemia, is a major worldwide health problem with a fastrising prevalence in India. Numerous macrovascular and microvascular problems are brought on by diabetes mellitus, with diabetic retinopathy, nephropathy, and neuropathy being the most common microvascular consequences. Peripheral vascular illnesses, cardiovascular diseases, and cerebrovascular diseases are the macrovascular consequences of diabetes mellitus. The length of hyperglycemia and diabetes mellitus determine the prevalence of problems in diabetics, which is higher in those with inadequate glycemic control.1

Because platelets are essential for maintaining homeostasis and for sealing arterial abnormalities by forming a primary plug, they require a phospholipid surface in order to activate and attract coagulation factors.

In response to endothelium-induced stimulation, platelets change shape, attach to sub-endothelial surfaces, release intracellular organelle content, and aggregate to create thrombus. Therefore, in diabetic patients, platelets may be essential in signaling the onset of severe atherosclerosis.[2,3]

One accurate indicator of platelet function and activation is platelet volume. The mean platelet volume is determined using hematology analyzers. Procoagulant protein appears on the surface of platelets as P-selectin or glycoprotein IIIa. The average size of the platelets in a subject's blood is shown by the mean platelet volume. According to several reports, hyperglycemia is associated with bigger platelets with a greater mean platelet volume. Thus, an increase in thrombotic potential can be associated with an increase in mean platelet volume and platelet distribution width.[4]

Myocardial infarction, stroke, and thromboembolism are all significantly impacted by a rise in MPV. HbA1c and mean platelet volume are associated with the occurrence of cardiovascular problems in individuals with type 2 diabetes mellitus. The mean platelet volume is larger in individuals with diabetes mellitus than in those with appropriate glycemic control.5

Platelet function has a physiological role in atherothrombotic illness, and both type 1 and type 2 diabetes mellitus have substantial evidence of platelet dysfunction and hyperreactivity. Additionally, platelets are essential for the development of diabetic angiopathy. 6. At a medical facility in India, the current study sought to compare the mean platelet volume of subjects with and without diabetes.

MATERIALS AND METHODS

The goal of the current cross-sectional prospective clinical investigation was to compare the mean platelet volume of participants with and without diabetes at Indian healthcare facilities. The research participants came from the Institute's Department of Medicine. Prior to their involvement in the study, all participants gave their verbal and written informed permission.

A total of 600 participants were enrolled in the study: 300 individuals with a verified prior diagnosis of type 2 diabetes and another 300 individuals without the disease. Participants in the study had to be between the ages of 20 and 80, have no history of peripheral vascular disease, cerebrovascular disease, or coronary artery disease (for those without diabetes), or have a confirmed diagnosis of type 2 diabetes mellitus (for those with diabetes).

Those under 20 or over 80 years old, non-diabetic individuals taking antiplatelets like clopidogrel or aspirin, non-diabetic individuals with peripheral vascular, cerebrovascular, or coronary artery diseases, individuals with cancer, coagulation disorders, abnormal platelet counts, abnormal white blood cell counts, and/or abnormal hematocrit were all excluded from the study. Because nutritional anemia might raise mean platelet volume, the research additionally eliminated male participants with hemoglobin levels below 13 gm% and female participants with hemoglobin levels below 12gm%.

Following final inclusion, a thorough clinical examination was conducted after each subject's history was thoroughly documented. The Department of Pathology then collected blood samples from each subject, which were then processed from intravenous blood under stringent aseptic and sterile conditions in the Department of Biochemistry.

An automated hematology analyzer measured the blood samples' CBC (complete blood count), MPV (mean platelet volume), HbA1c, PPBS (postprandial blood sugar), and FBS (fasting blood sugar). HbA1c was measured by liquid chromatography and PPBS and FBS were evaluated using an automated bio-analyzer.

Based on their blood sugar levels, the research participants were then split into two groups: Group I consisted of people with diabetes, while Group II included those without the disease. Then, following conventional procedures, the height and weight of each patient were recorded.

SPSS was used to statistically analyze the collected data (Statistical Package for the Social Sciences) software version 21.0 (IBM Corp., Armonk. NY, USA) for assessment of descriptive measures, ANOVA independent t-test, Mann Whitney U test, and chi-square test. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered statistically significant.

RESULTS

In order to compare the mean platelet volume of individuals with and without diabetes in Indian healthcare facilities, cross-sectional prospective clinical research was conducted. An overall sample size of 600 participants was included in the study,

comprising 300 individuals with a verified prior diagnosis of type 2 diabetes and another 300 individuals without the disease. Group I and Group II study participants had mean ages of 47.3±8.61 and 45.3±9.25, respectively, which was statistically not significant (p>0.05). The gender distribution of Group I was 54% (n=162) male and 46% (n=138) female, whereas Group II included 52% (n=156) male and 48% (n=144) female. With p>0.05, there were statistically insignificant variations between age and gender. At 25.03±6.34 and 22.55±4.26 kg/m2, respectively, the mean BMI of Group I and II participants was statistically non-significant (p>0.05).

As indicated in Table 1, the mean platelet concentration (MPC) for Group I and II subjects was 254±0.5 and 261±0.7 X109/L, respectively, indicating statistical non-significance with p>0.05. The fasting blood sugar levels of Group I and II participants were found to be 146.47±42.63 mg/dl and 83.73±10.71 mg/dl, respectively. Group I patients had considerably higher blood sugar levels (p<0.05). With 249.62±82.25 mg/dl in Group I and 148.41±27.22 mg/dl in Group II, PPBS was substantially greater in Group I individuals (p<0.05). Group I participants had a mean HbA1c of 8.73±2.54, which was substantially higher than Group II subjects' mean HbA1c of 5.62±0.55 (p<0.05). Between Group I and Group II, the mean platelet volume was 9.87±1.26 and 8.84±1.13, respectively, indicating statistical significance with p<0.05 (Table 1).

With a p-value of less than 0.05, it was observed that there was a significant link between the mean platelet volume and postprandial blood sugar, fasting blood sugar, and HbA1c in the research participants. However, as shown in Table 2, there was a statistically non-significant correlation between mean platelet volume and BMI (p=0.34) and mean platelet volume and the length of diabetes mellitus (p=0.44).

The results of the study demonstrated that, when comparing the diabetic population in Group I and II, the PPBS of Group II subjects was significantly higher than that of Group I subjects with a HbA1c of <6.5 and Group II subjects with a HbA1c of >6.5 (p<0.005). However, Group II participants had substantially greater fasting blood sugar (p<0.005). The HbA1c and platelet counts did not differ significantly (p=0.43). Group II participants had a substantially greater BMI than Group I participants (p=0.02). Group II individuals' mean platelet volume was substantially greater than Group I subjects' (p=0.005) (Table 3).

DISCUSSION

The current study evaluated a total of 600 subjects, 300 of whom had a confirmed prior diagnosis of type 2 diabetes and 300 of whom did not previously have the disease. Group I and Group II study participants had mean ages of 47.3±8.61 and 45.3±9.25, respectively, indicating a statistically non-significant difference (p>0.05). The gender distribution of Group I was 54% (n=162) male and 46% (n=138) female, whereas Group II included 52% (n=156) male and 48% (n=144) female. With p>0.05, there were statistically insignificant variations between age and gender.

Group I and II participants had mean BMIs of 25.03±6.34 and 22.55±4.26 kg/m2, respectively, which were statistically non-significant (p>0.05). The mean platelet concentration (MPC) for Group I and II participants was 254±0.5 and 261±0.7 X109/L, respectively, indicating statistical non-significance with p>0.05. These features were shared by Shah B et al.'s (2012) and Yenigün EC et al.'s (2014) research, in which the authors evaluated participants using similar demographic and medical data to the current study.

The fasting blood sugar levels in Group I and II patients were 146.47±42.63 mg/dl and 83.73±10.71 mg/dl, respectively. Group I subjects had considerably higher blood sugar levels (p<0.05). With 249.62±82.25 mg/dl in Group I and 148.41±27.22 mg/dl in Group II, PPBS was substantially greater in Group I individuals (p<0.05).

Group I participants had a mean HbA1c of 8.73±2.54, which was substantially higher than Group II participants' mean HbA1c of 5.62±0.55 (p<0.05). In Group I, the mean platelet volume was 9.87±1.26, while in Group II, it was 8.84±1.13, indicating statistical significance with p<0.05. These findings aligned with research conducted by Agarwal K et al. in 2020 and Dubey I et al. in 2017, both of which reported blood parameters comparable to the current investigation. There was a significant link between mean platelet volume and postprandial blood sugar, fasting blood sugar, and HbA1c, with a p-value of less than 0.05, according to the study's findings.

Nonetheless, there was a statistically insignificant correlation between mean platelet volume and BMI (p=0.34) and mean platelet volume and the length of diabetes mellitus (p=0.44). These results concurred with those of the 2017 study by Madhavan K et al. and the 2021 study by Venkatesh V et al., who found a significant correlation between mean platelet volume and postprandial blood sugar, fasting blood sugar, and HbA1c in diabetics.

Group I participants with a HbA1c of less than 6.5 and Group II subjects with a HbA1c of greater than 6.5 were found to have substantially higher PPBS than Group I patients ($p<0.005$) when comparing the diabetic population in groups I and II.

However, Group II participants had substantially greater fasting blood sugar ($p<0.005$). Platelet counts and HbA1c showed a non-significant difference ($p=0.43$). Subjects in Group II had a substantially greater BMI than those in Group I ($p=0.02$). Group II patients had a considerably greater mean platelet volume than Group I subjects ($p=0.005$). These findings were consistent with those of the 2017 study by Buch A et al.13 and the 2017 study by Manta A et al.14, whose authors reported findings that were comparable to those of the current investigation.

CONCLUSION

In participants with poor glycemic control and prognostic indicators for vascular consequences of diabetes, mean platelet volume is substantially correlated with diabetes mellitus. To draw a firm conclusion, further longitudinal research is necessary in the future.

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Characteristics	Group I diabetics (n=300)	Group II (n=300)	p-value
Mean age (years)	47.3±8.61	45.3±9.25	>0.05

Gender	n	%	n	%	
Males	162	54	156	52	>0.05
Females	138	46	144	48	
FBS (mg/dl)	146.47±42.63		83.73±10.71		<0.05
PPBS (mg/dl)	249.62±82.25		148.41±27.22		<0.05
BMI (kg/m2)	25.03±6.34		22.55±4.26		>0.05
HbA1c	8.73±2.54		5.62±0.55		<0.05
MPC ($X10^9$/L)	254±0.5		261±0.7		>0.05
MPV (fl)	9.87±1.26		8.84±1.13		<0.05

Table 1: Comparison of different characteristics and parameters in study subjects

Characteristics	Parameter	p-value
MPV (fl)	PPBS	<0.05
MPV (fl)	FBS	<0.05
MPV (fl)	HbA1c	<0.05
MPV (fl)	BMI	0.34
MPV (fl)	Diabetes duration	0.44

Table 2: Correlation of mean platelet volume to different parameters in study subjects

Characteristics	Group I HbA1c<6.5 (n=300)	Group II HbA1c >6.5 (n=300)	p-value
PPBS (mg/dl)	149.7±46.6	270.3±89.13	<0.005
FBS (mg/dl)	83.11±18.14	161.5±72.33	<0.005
HbA1c	6.56±0.43	9.11±3.3	-
Platelets ($X10^9$/L)	290.13±66	276.3±84	0.43
BMI (kg/m2)	23.3±2.87	25.17±4.4	0.02
MPV (fl)	7.87±0.67	8.13±0.71	0.005
Total subjects	50	250	-

Table 3: Comparison of diabetic population in group I and II study subjects